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(3.) The Monotreme-Marsupial line have developed a number of foramina in their own special way.

(4.) The *Rodentia* have chiefly developed those of the inferior part of the squamosal bone, if any.

(5.) The *Carnivora* commenced with but few foramina, and have obliterated these on attaining their highest development.

(6.) The history of the *Quadrumana* is identical with that of the *Carnivora*.

(7.) The *Perissodactyla* present very few foramina in the lowest forms, and did not increase them in the line of the *Rhinoceridæ*. In the line of the horses an increase in their number appeared early in geologic time, and is fully maintained in the existing species.

(8.) In the Omnivorous division of the *Artiodactyla* time has obliterated all the sinous foramina. In the camels an increased number was apparent at the same geologic period as in the history of the horses (White River or Lowest Miocene), and has been maintained ever since; while the existing *Pecora* present a larger number of the foramina than any of the class of the *Mammalia*.

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GENERAL NOTES.

BOTANY.

THE HUMBLE BEE A DYSTELEOLOGIST AMONG ALPINE FLOWER VISITORS.[1]—In the interesting article of which this is an abstract, Dr. Hermann Müller considers the disteleological actions of the alpine humble bee (*Bombus mastrucatus*).

As Haeckel has shown, structures which are useless or harmful to the possessor are at once the most insurmountable obstacles to teleology and the finest foundation for disteleology. Very important among these are rudimentary organs; but this field is much more comprehensive than Haeckel made it, or, indeed, could have made from his morphological standpoint, for rudimentary organs are always at first the morphological results of biological causes, and may always be traced to some change of habits in living beings. Their uselessness begins not with the commencement of atrophy, but with the change of habits which is the cause of this atrophy.

The different living beings of any given place are so variedly and closely connected by their mutual relations that a change in the habits of one species is indicated not only by the consequent uselessness of its own organs but also by the accompanying uselessness of those of other species which were closely adapted to it under former conditions. The numerous, well-determined mutual relations existing between flowers and insects serve especially well in the study of disteleology. The closeness of these relations Dr. Müller has shown in previous articles.[1] Any change in the one must react on the other and produce some effect. For example, no teleologist could desire a more perfect adaptation of two forms one to another than is afforded by the sucking mechanism of the humble-bee and the complicated lever-work for securing pollination in the meadow-sage. But if it chance—and this is really the case in some places—that there are found with the ordinary form of this sage small-flowered varieties which are visited, on an average, later than the large-flowered form, and therefore are fertilized by pollen taken from the latter, the beautiful lever-mechanism of the anthers in the small flowers becomes useless at once, and passes from the province of teleology into that of disteleology; it becomes a rudimentary organ, and as such is actually found in all degrees of atrophy. Or, again, if a species of humble bee belonging to the most frequent visitors of these flowers should find it too much trouble to set the anther-levers in motion, and should take to perforating the floral envelopes from the outside and through these stealing the nectar, it would not only cease to employ its tongue in a way fully corresponding to the degree of its development, but it would render the anther-mechanism of the flowers entirely useless in all of its visits. Indeed, were the not improbable case to occur, in which other species of bees, finding the nectar constantly gone from these flowers, should entirely lose their habit of visiting them, the flowers would never be fertilized, and the meadow-sage would die out in the regions where this occurred. The change in habits of the piratical bee would thus have as a result the changing of the habits of all other humble bees; and from the moment when this occurred the wonderful contrivances by which no insects but these bees can fertilize the flowers would become not only useless but absolutely destructive, and this, without the formation of rudimentary organs. Such a bee, obtaining nectar by robbing from flowers adapted to its visits for their fertilization sets at nought the theory of teleology, and merits in a high degree the name of a disteleologist.

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[1] "Bombus mastrucatus, ein Dysteleolog unter den alpinen Blumenbesuchern." Dr. Hermann Müller, Kosmos, Band III, Heft 6, p. 422.

Of this character is the *Bombus mastrucatus* of the Alps; which, moreover, does not content itself with breaking into and stealing nectar from flowers which it cannot enter in the normal way, but has become so addicted to the exercise of violence that it only enters a flower regularly when this is less trouble than perforating its corolla.

The good deeds of this insect, and those by which it is connected with the theory of teleology, are few in number, and confined almost exclusively to such flowers as those of the Compositæ, which are not especially adapted to bees, but are open to the visits of all insects. But while it visits these in the normal way—

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[1] See the NATURALIST for April, 1879, p. 257.

because it would be more trouble to get at their nectar in any other—its more ravenous appetite and greater dependence upon plant-food are the only causes which render its visits more frequent than those of less-specialized insects, and its value to the plant greater; for visit for visit, they are as effective in fertilizing the flowers as it is. Such flowers as those of *Thymus serpyllum*, which are only slightly modified, are not as a rule perforated ; nor are pendant flowers like those of *Campanula rapunculoides*. But of bee-flowers like those of *Aconitum napellus* very few are visited regularly before a systematic perforation of their corollas is begun. In a few other cases where this bee either leaves the nectar untouched or obtains it by force it collects pollen, and in so doing aids in the fertilization of the flowers.

Were we only to count the flowers which this bee visits in the normal way, and those which it perforates, we might infer that its good and evil deeds stand pretty evenly balanced; nevertheless it would always remain a disteleologist because it seldom uses its own organs in a way corresponding to the completeness of their development, and, moreover, breaks ruthlessly through the most highly developed floral structures, so that to a certain extent both its own organs and those of the flower are rendered useless. But to fully appreciate its injuriousness we must note how greatly it prefers those richly nectariferous flowers which it perforates to those with less nectar which it visits normally. So great is this preference that it is astonishing to see how few flowers of such species as *Salvia pratensis* remain unperforated.

Bad in itself, this habit of perforating flowers is rendered still worse for the plants by the habit which certain other insects have of obtaining nectar through openings already formed, though they would not form any for themselves. This limits still more the number of useful visitors of the flowers. Hence it is not improbable that this bee may have been the cause of the extinction of many alpine plants; and one can scarcely doubt that changes in flowers which tend to check or stop perforation by it have been taken up and developed by natural selection from the time when this unnatural action first began. An instance of partial protection against this bee is afforded by *Rhinanthus alectorolophus*, where the inflated calyx and the firm, smooth arch of the corolla together protects the flowers from forcible removal of their nectar, and force the bee to aid in their fertilization or go without the sweets. In *Pedicularis verticellata* the perforation of the floral envelopes is partially prevented by the globular form of the calyx, the abrupt, rectangular bend of the corolla within, and its smooth, laterally compressed condition without the calyx.

It is easily seen why rudimentary organs are not formed in flowers robbed of their nectar by our bee; for bee- and butterfly-flowers which are thus treated either receive enough visits from other species to ensure their fertilization and prevent the abortion of their organs, or their other visitors are crowded out to such an extent that the plant perishes at once, giving no opportunity for the formation of any rudiments. Nor can the sucking apparatus of the bee become rudimentary, for it is employed constantly in obtaining nectar even from those flowers which are broken into. Only in case the robber-bee formed the habit of biting off all nectar-containing parts, or of stealing honey already collected by other bees, could its tongue become abortive. What would occur in the the latter case is seen in the Brazilian *Trigona limæ*, which has this habit. The disused tongue is here very small, while the mandibles, being more frequently used, are unusually large and strong.—*W. Trelease.*

BOTANICAL NOTES.[1]—The *Botanical Gazette*, for December, furnishes articles by C. C. Pringle, on dimorpho-dichogamy in *Juglans cinerea*, and on the leaf propagation of *Nasturtium lucustre.* To the January number Dr. Gray sends notes on Tennessee plants and records the occurrence of Littorella and Schizæa in Nova Scotia. Dr. George Engelman writes on *Catalpa speciosa.* In the February number are notes on *Viola tricolor* by Prof. T. C. Porter.——To the *Bulletin* of the Torry Botanical Club, for December, 1879, Mr. Pringle contributes notes on Northern New England plants, and *Aspidium spinulosum* is noticed critically by Mr. B. D. Gilbert. The death of Dr. F. J. Bumstead, a student of vegetable anatomy and physiology, which occurred November 28th, is also announced.——The *California Horticulturist* always contains a good deal of botanical matter of general interest; to the January number S. B. Parish contributes a notice of the Pentstemons of Southern California.——In Trimen's *Journal of Botany*, for January, is a plate representing a curious pitcher plant (*Nepenthes dyak*), and an article by G. Nicholson on *Spergula arvensis.* Reference is made to an article by P. Sagot on the influence of the hygroscopic state of the air on vegetation. The death of Dr. H. Bauke, December 15, is announced. He was well known by his work on Pycnidia, fern prothallia, &c.——The January number of the *Quarterly Journal of Microscopical Science* contains several botanical articles of special value. H. M. Ward discusses the embryo-sac and development of *Gymnadenia conopæa;* the pollen-bodies of Angiosperms are treated of by F. Elfving; the development of the conceptacle in the Fucaceæ, by F. O. Bower. In his article on the Bacillus of leprosy, G. A. Hansen describes and figures Bacilli found in leprosy tubercles and pus, but does not go so far as Neisser and Edlund in attributing this loathsome disease to these microphytes.——Contrary to Darwin's conclusions that Drosera is carnivorous, Prof. Regel finds, on comparing a number of plants fed with meat with a series which were not, that while the average weight of the seeds was greater in the former case, this was more than compensated by their much smaller number, the gross weight being considerably less. He found also that the leaves were obviously injured by the flesh food and that the power of the plants to resist the winter was diminished. He thinks the epithet "carnivorous" to be inappropriate. On the other hand, Von Heldrich, according to the *Journal* of the Royal Microscopical Society, has found a Pinguicula on the upper side of whose leaves are a large number of bodies of insects in an earlier or later stage of digestion by the glands plentifully sprinkled over its surface. This is the first insectivorous plant yet recognized in Greece.——By the will of the late Stephen C. Olney, of Providence, R. I., his herbarium of from 8000 to 10,000 species of plants, and his library of botanical works numbering some four hundred volumes, and an excellent microscope, with $10,000 for the increase of the library and herbarium, have been bequeathed to Brown University. The library contains many costly works. The herbarium comprises, besides a fine series of Carices, on which the donor bestowed much labor, many Western and South-western plants named by Gray, Cuban plants, Austin's, Sullivant and Lesquereux's mosses, and good series of algæ and lichens. The author's botanical labors were recognized some years since in the establishment of the genus Olneya. The College also receives from him the sum of $25,000 for a professorship of natural history.

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[1] A portion of these notes were crowded out of the March number.—EDITORS.

ZOÖLOGY.[1]

TWENTY-SIX DAYS AT SEA, IN AN OPEN BOAT, CRUISING FOR WHALES.—We left San Francisco on a small steam propeller known as the *Rocket;* length about thirty-five feet, eight feet beam, and about five and a-half tons register.

The day we left being fine, we had a very pleasant trip as far as Point Reyes, which is about thirty-five miles north of San Francisco, but saw nothing of importance on the way, except now and then numerous albicore and the porpoises sporting in the sea. We anchored in Drake's bay for the night. Early on the following morning we steamed up and took a cruise outside, and in a few hours heard the familiar sound, "There she 'blows,'" and the captain, with spy-glass in hand, answering, "Where-away?" with the answer, "Just on the lee bow, about half a mile ahead!" Getting everything in order, we steered for him, and soon saw several whales swimming very fast and going northwards. Now one approaches which proves to be a sulphur bottom whale (*Sibbaldius sulphureus* Cope), seventy-five to eighty feet long, just under the bow of the boat, in fact almost too close for a shot. The captain fired one of the well-known Fletcher, Suits & Co. California whaling rockets, and patent bomb lance. This apparatus consists of a gun-metal cylinder filled with a peculiar composition made only by themselves, to which is attached, in front, a bomb

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[1] The departments of Ornithology and Mammalogy are conducted by Dr. ELLIOTT COUES, U. S. A.